20 March 2002
File No. 27285-003

Mr. Brian Mossman
Boeing Realty Corporation
3855 Lakewood Blvd.
Building 1A MC D001-0097
Long Beach, California 90846

Subject: **Site Closure Evaluation - Parcel B Deep Soil, Boeing Realty Corporation (BRC) Former C-6 Facility, Los Angeles, California**

Dear Mr. Mossman:

Haley & Aldrich, Inc. (Haley & Aldrich) has conducted an evaluation for recommended closure of deep soil (vadose zone soil at depths greater than 12 feet below ground surface [bgs]) at the subject property (Parcel B). Parcel B is one of four parcels (Parcels A through D) of the BRC Former C-6 Facility, at 19503 South Normandie Avenue, in Los Angeles, California.

EXECUTIVE SUMMARY

BRC has completed their investigation and risk assessment evaluation of deep soil within Parcel B. These activities included:

- Investigation of the vertical and lateral extent of soil impacts
- Investigation of impacts to groundwater
- Groundwater monitoring for the presence of volatile organic compounds (VOCs)
- Preparation of risk assessment work plans
- Evaluation of the potential for adverse health effects from residual soil and groundwater impacts
- Evaluation of the potential impacts on groundwater quality from residual soil impacts

Based on the closure evaluation presented herein, it is recommended that the Regional Water Quality Control Board – Los Angeles Region (RWQCB) issue a "no further action" letter for deep soil impacts in Parcel B based on the following information and conclusions:

1. Both the vertical and lateral extent of soil impacts related to onsite operations have been delineated.

2. In a letter dated January 7, 2000 (RWQCB 2000), the RWQCB issued a letter of no further action for shallow soil in Parcel B. No known sources of VOC impacts have been discovered on Parcel B.

3. The post-demolition risk assessment, approved by the California Department of Toxic Substances Control (DTSC), indicates that the soil at any depth, including deep soil, does not pose a risk to human health greater than the Office of Environmental Health Hazard

Assessment (OEHHA)-approved levels from inhalation of VOCs by upward VOC vapor migration into onsite buildings. No other exposure pathways are considered complete for deep soil.

4. The following additional potential exposure pathways were evaluated using deep soil investigation results:

   - inhalation of VOCs in indoor air from upward VOC vapor migration from groundwater into onsite buildings, and

   - inhalation of VOCs in indoor air due to VOC migration from deep soil leachate to groundwater and subsequent upward VOC vapor migration from groundwater into indoor air.

   Adding the estimated risks for Parcel B from the above-listed pathways to the risks calculated for potential onsite receptors, as presented in the post-demolition risk assessment, does not result in risks greater than OEHHA-approved risk levels for the BRC Former C-6 Facility property.

5. The existing residual chemical concentrations in onsite deep soil do not pose a threat to groundwater quality at concentrations greater than California drinking water standards.

1.0 BACKGROUND

1.1 SITE LOCATION

Parcel B is located within the BRC Former C-6 Facility at 19503 South Normandie Avenue, in Los Angeles, California. The approximate location of Parcel B is depicted in Figure 1. A site plan is presented as Figure 2.

1.2 SITE LAND USE HISTORY

Parcel B occupies the western portion of the 170-acre Facility and is bordered by West 190th Street to the north; Parcel A, C and D to the east; Montrose Chemical and residential properties to the south; and Western Avenue, Capitol Metals, and ILM to the west (Figure 3). Aerial photographs indicate that the area was farmland before the 1940s. Industrial use of Parcel B began in 1941 when it was developed as part of an aluminum reduction plant. Prior to 1952, the aluminum reduction plant was converted to a steel manufacturing facility. In 1952, the Douglas Aircraft Company (DAC) used the facility to manufacture aircraft and aircraft components until approximately 1992. Parcel B has been primarily used for employee parking since DAC began operating the facility in 1952 (Integrated, 1998a, references listed in Appendix A). A cluster of buildings at the center of the parcel separated the parking area into northern and southern lots.

A tool and scrap storage yard serviced by railroad spur tracks occupied the southern portion of Parcel B. DAC used the buildings primarily for office space and storage. The property ownership was transferred to The Boeing Company during a merger with McDonnell Douglas Corporation in 1997. Currently, the former manufacturing facility has been demolished and Parcel B is being redeveloped for commercial/industrial use.

2.0 SITE INVESTIGATION RESULTS

2.1 SITE INVESTIGATION HISTORY

An evaluation of the previous investigation was conducted to assess whether the deep soil has been adequately characterized laterally and vertically for risk assessment and closure of Parcel B deep soil.

A review of the previous reports (listed in Appendix A) indicates that soil was investigated to depths of approximately 50 feet bgs. The water table is located at approximately 65 feet bgs. Two hundred twenty-nine (229) soil samples were collected within 52 borings at depths ranging between 0.5 and 50 feet bgs and were analyzed for VOCs, semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), total recoverable petroleum hydrocarbons (TRPH), polychlorinated biphenyls (PCBs), pesticides, and metals. Concentrations of detected compounds are shown on Figures 4, 5, and 6. (KJC 1998, Integrated 1998a and 1999).

The Parcel B Post-Demolition Risk Assessment report (Integrated 1998b) indicates that metals concentrations measured in onsite soil samples are within natural background levels, with the exception of arsenic. Arsenic was detected above natural background levels in two soil samples, sample 5-4-40_P_40_030597_1 collected from 40 feet bgs and sample AOI4-EV1 @ 51'_P_51_070298_1 collected from 51 feet bgs.

Organic chemicals detected in deep soil samples from Parcel B include:

- Bis(2-ethylhexyl)phthalate
- 1,1-Dichloroethene (1,1-DCE)
- Napthalene
- Tetrachloroethene (PCE)
- Toluene
- Trichloroethene (TCE)
- Petroleum hydrocarbons (as total recoverable petroleum hydrocarbons [TRPH], e.g., heavier carbon-chain organics such as motor oil)

Organic chemicals detected in groundwater beneath Parcel B include:

- Benzene

- Carbon disulfide
- Carbon tetrachloride
- Chloroform
- 1,1-Dichloroethane (1,1-DCA)
- 1,1-DCE
- cis-1,2-Dichloroethene
- Ethylbenzene
- Isopropyl benzene
- Methylene chloride
- Methyl ethyl ketone (2-butanone)
- PCE
- Toluene
- TCE
- 1,2,4-Trimethylbenzene
- Vinyl chloride
- Xylenes
- Bis(2-ethylhexyl)phthalate

Review of the concentrations for the soil samples indicate that the reported chemical concentrations related to releases originating from Parcel B operations appear to be adequately delineated both vertically and horizontally as shown in Figures 4, 5 and 6. RWQCCB concurred in a letter dated January 7, 2000 (RWQCB 2000), stated that "Boeing adequately assessed and characterized potential soil impacts from chemicals at the site."

2.2 CHEMICALS OF POTENTIAL CONCERN

Calculation of human health risk and evaluation of threat to groundwater quality requires identification of the chemicals of potential concern (COPCs). COPCs were identified as those chemicals that could pose a human health risk due to vapor migration into buildings or a threat to groundwater quality at concentrations above drinking water standards. The COPCs for soil and groundwater are presented below, along with their maximum detected onsite concentrations.

Soil

• Arsenic	25 milligrams per kilogram (mg/kg)
• Bis (2-ethylhexyl) phthalate	4.4 mg/kg
• 1,1-DCE	0.044 mg/kg
• PCE	0.0050 mg/kg
• TCE	0.170 mg/kg
• Toluene	0.0030 mg/kg

Groundwater

- Benzene 0.00081 milligrams per liter (mg/l)
- Carbon disulfide 0.370 mg/l
- Carbon tetrachloride 0.0015 mg/l
- Chloroform 0.0051 mg/l
- 1,1-DCA 0.00035 mg/l
- 1,1-DCE 0.00058 mg/l
- cis-1,2-Dichloroethene 0.012 mg/l
- Ethylbenzene 0.00023 mg/l
- Isopropyl benzene 0.00032 mg/l
- Methylene chloride 0.006 mg/l
- MEK 0.0056 mg/l
- PCE 0.025 mg/l
- Toluene 0.017 mg/l
- TCE 10 mg/l
- 1,2,4-Trimethylbenzene 0.00043 mg/l
- Vinyl chloride 0.0030 mg/l
- Xylenes 0.0014 mg/l

These data were used to complete the human health and groundwater impact assessment for Parcel B deep soil. It should be noted that the potential health risks associated with TRPH are assessed according to their toxic components (e.g. PAHs and aromatic hydrocarbons such as benzene).

3.0 HUMAN HEALTH RISK ASSESSMENT

Risk assessments have been performed to evaluate if chemicals present at Parcel B pose a human health risk above OEHHA-approved risk levels. A post-demolition risk assessment was performed in 1998 (Integrated, 1998a) and risk assessment calculations were performed as part of this evaluation for Parcel B. A brief summary of the post demolition risk assessment is provided, followed by a discussion of the human health risk assessment calculations performed for this report.

3.1 HISTORICAL RISK ASSESSMENTS

A post-demolition risk assessment was conducted in 1998 to evaluate "the health protectiveness of post-demolition site conditions" (Integrated 1998b). The analytical results of the soil samples were compared to health-based remediation goals (HBRGs) for the BRC Former C-6 Facility property (Integrated 1997). The HBRGs were used as screening levels to identify areas likely requiring remedial excavation. This data comparison indicated that no areas on Parcel B were found to contain chemicals at levels that warranted remediation (KJC 1998, Integrated

1998a and 1999). The RWQCB confirmed in a letter dated January 7, 2000, that no further action is required for the Parcel B shallow soil (0 to 12 feet bgs). The California Human and Ecological Risk Division (HERD) further indicated in their March 9, 1999 memo that it agreed with the conclusion in the post-demolition risk assessment that residual shallow and deep soil impact risks "fall within a range of values that HERD determines to be acceptable for the proposed land use and will not pose significant health risks for future site occupants."

Although an evaluation of human health risks from potential exposure to deep soil impacts was performed and indicated no significant health risks, an evaluation of risk associated with existing or potential future groundwater concentrations due to migration of residual deep soil impacts was not performed. Therefore, no deep soil closure was issued. To address these risk issues, a supplemental assessment was performed.

3.2 SUPPLEMENTAL HUMAN HEALTH RISK ASSESSMENT

A review of the post-demolition risk assessment (Integrated 1998b) indicated that the following two human health exposure pathways associated with existing and potential future groundwater impacts were not considered:

- inhalation of VOCs in indoor air from upward VOC vapor migration from groundwater into onsite buildings, and

- inhalation of VOCs in indoor air due to VOC migration from deep soil leachate, migration to groundwater, and subsequent VOC vapor migration from groundwater into indoor air.

No other additional exposure pathways are considered complete for deep soil. Thus, the above-noted potential exposure pathways not previously addressed in the post-demolition risk assessment were evaluated and summarized herein.

The risk assessment calculations are described in Appendix B, and the results are presented in Appendices B and C. Adding the estimated risks from the above-listed pathways (risk assessment modeling output presented in Appendix C) to the potential onsite receptor risks presented in the post-demolition risk assessment do not result in risks greater than the OEHHA-approved risk levels.

4.0 POTENTIAL THREAT TO GROUNDWATER ASSESSMENT

The post-demolition risk assessment did not consider the potential threat to groundwater due to chemical leaching from deep soil impacts. Thus, potential degradation of groundwater quality due to chemical leaching from deep soil to groundwater was evaluated and summarized herein.

Results of our evaluation (detailed in Appendix B) indicate that leaching of maximum COPC concentrations in deep soil of Parcel B would not result in potential groundwater concentrations that are greater than MCLs, with the exception of TCE. In addition, measured concentrations of TRPH are less than their residual saturation concentration of 14,000 mg/kg in onsite soil (assumed to be silty sand) and, therefore, do not pose a threat of free product generation on the groundwater table.

For TCE, a comparison between estimated maximum TCE concentrations in groundwater, due to chemical leaching to groundwater, and measured TCE concentrations in groundwater was conducted to assess whether the existing TCE concentrations in soil may further degrade existing groundwater quality. The RWQCB acknowledged in their January 7, 2000 letter (RWQCB, 2000) that groundwater beneath Parcel B had been impacted by VOCs originating from off-site sources. No known sources of VOC impacts have been discovered on Parcel B. Thus, the TCE concentrations in deep soil and groundwater in this area appear to have originated from the ILM site west of Parcel B (Figure 4). Figure 7 presents a summary of the TCE concentrations in groundwater beneath Parcel B.

As discussed in Appendix B, the estimated maximum groundwater concentration resulting from migration of potential onsite TCE-impacted soil leachate is over seven hundred times less than the most recently measured maximum TCE concentration in the groundwater (10 mg/l). This groundwater sample was collected from monitoring well DAC-P1 which is situated closest to the boring (2BB-1A-6) with the greatest onsite soil concentration of TCE (0.170 mg/kg). Groundwater beneath and in proximity to Parcel B will not likely be used for domestic water supply purposes. Therefore, based on these calculations and information, the existing residual chemical concentrations in onsite deep soil do not pose a further threat to groundwater quality.

5.0 SUMMARY AND CONCLUSIONS

Based on the closure evaluation presented herein, it is recommended that no further action be granted by the RWQCB for deep soil impacts at Parcel B based on the following information and conclusions.

1. A review of the results of the deep soil investigation activities conducted at Parcel B from 1991 through 1998 indicates that both the vertical and lateral extent of soil impacts from releases originating from Parcel B operations have been delineated. Relatively low concentrations of bis(2-ethylhexyl)phthalate, naphthalene, 1,1-dichloroethene, tetrachloroethene, toluene, trichloroethene, and TRPH have been detected in onsite soil between depths of 12 and 50 feet bgs. Elevated concentrations of TCE have been detected in onsite deep soil at depths between 40 and 50 feet bgs and in groundwater. Other chlorinated VOCs have also been detected in onsite groundwater. However, no source of these chemicals originating from Parcel B operations has been identified. Chlorinated VOCs have been detected in groundwater migrating from the ILM site onto Parcel B. Thus,

it appears that the concentrations of chlorinated VOCs detected in deep onsite soil samples may be attributed to chemical migration from the ILM site west of Parcel B.

2. In a letter from the RWQCB dated January 7, 2000, the RWQCB stated that "Boeing adequately assessed and characterized potential soil impacts from chemicals at the site".

3. Parcel B risk assessment guidelines were developed in the document entitled *HBRGs for Surface Soils* (Integrated, 1997) and results of the initial post-demolition risk assessment are included in the Parcel B Post-Demolition Risk Assessment report (Integrated 1998).

4. In a memo dated March 9, 1999, the HERD indicated that it agreed with the conclusion in the post-demolition risk assessment that residual shallow and deep soil impacts in Parcel B do not pose health risks greater than acceptable levels. The potentially complete exposure pathway identified in the post-demolition risk assessment for deep soil included possible inhalation of vapors that have migrated from soil into buildings. Estimates of human health risk from this exposure pathway were calculated using VOC concentrations detected throughout the soil column, including deep soil. The post-demolition risk assessment (Integrated 1997) indicates that the soil does not pose a risk to human health greater than acceptable levels from inhalation of VOCs from upward VOC vapor migration into onsite buildings.

5. The following additional potential exposure pathways were evaluated using deep soil investigation results:

   - inhalation of VOCs in indoor air from upward VOC vapor migration from groundwater into onsite buildings, and

   - inhalation of VOCs in indoor air due to VOC migration from deep soil leachate to groundwater and subsequent upward VOC vapor migration from groundwater into indoor air.

   Adding the estimated risks from the above-listed pathways to the risks calculated for potential onsite receptors, as presented in the post-demolition risk assessment, do not result in risks greater than the OEHHA-approved risk levels for the BRC Former C-6 Facility property.

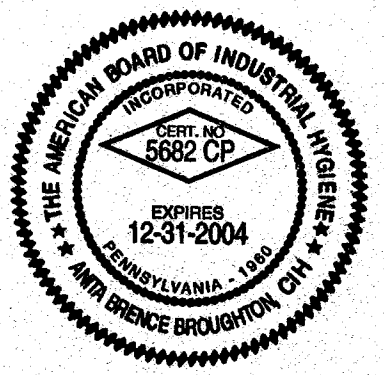
6. The existing residual chemical concentrations in onsite deep soil do not pose a threat to groundwater quality at levels greater than MCLs, with the potential exception of TCE. Only three samples collected at a depth of 40 and 50 feet bgs, adjacent to the ILM site, contain TCE concentrations that could further contribute to groundwater concentrations above the MCL. Concentrations of TCE in deep soil and groundwater in this portion of Parcel B appear to have originated from the ILM site. Comparison of the estimated maximum TCE concentrations in groundwater, due to chemical leaching to groundwater, to

measured TCE concentrations in groundwater indicates that existing TCE concentrations in soil will not further degrade existing groundwater quality.

If you have any questions regarding the content of this letter, please contact either of the undersigned at (619) 280-9210.

Sincerely yours,
HALEY & ALDRICH, INC.

Anita Broughton, REA, CIH
Risk Assessment Task Manager



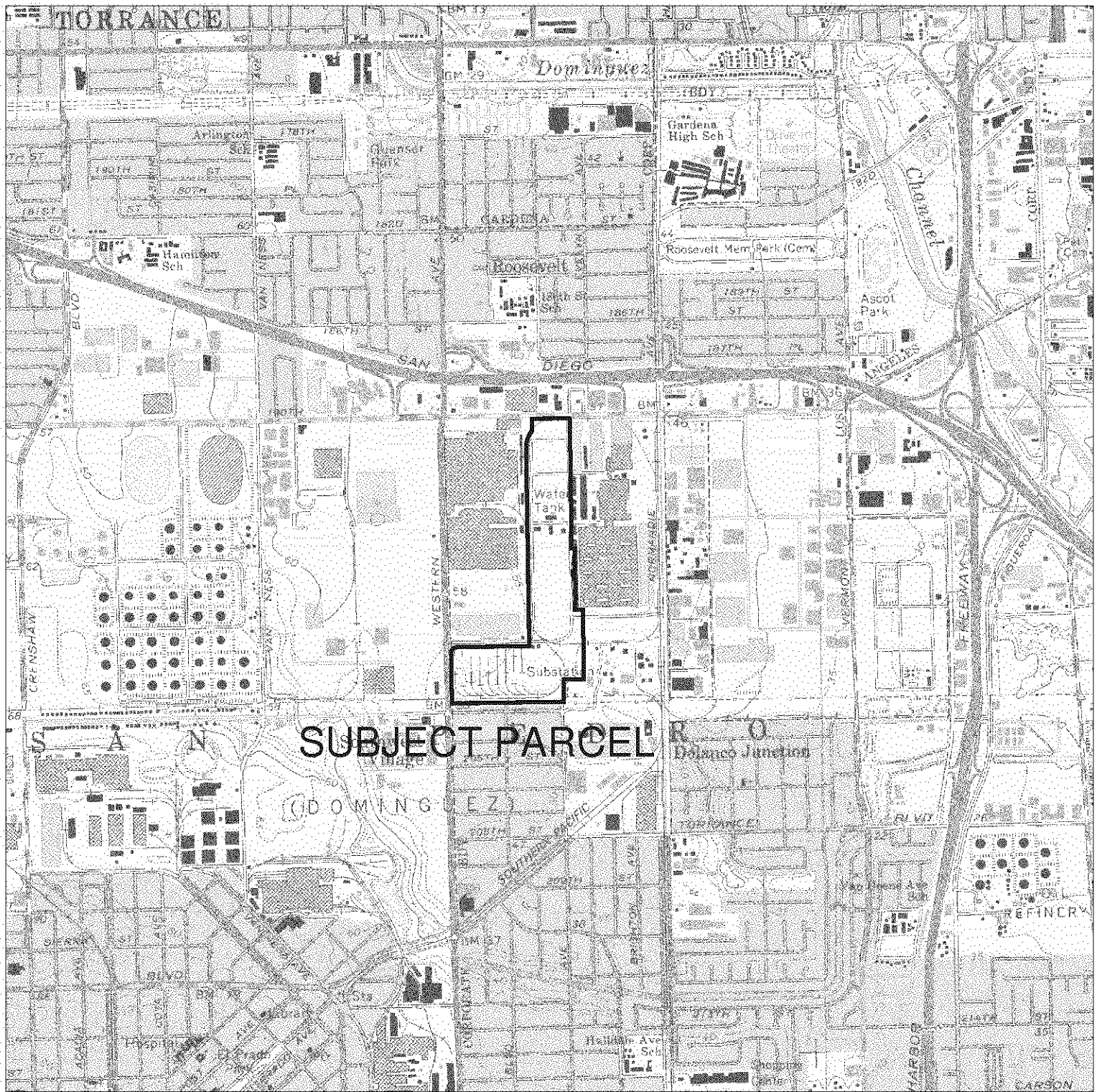
Richard M. Farson, P.E.
Senior Engineer

Scott Zachary
Project Manager

Attachments

List of Attachments

Figures



SOURCE: USGS 7.5 MINUTE TORRANCE, CALIFORNIA QUADRANGLE 1 JULY, 1981

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LOS ANGELES, CALIFORNIA

FIGURE: 1

PARCEL B
LOCATION MAP

SCALE: AS SHOWN		PROJECT: 27285-003
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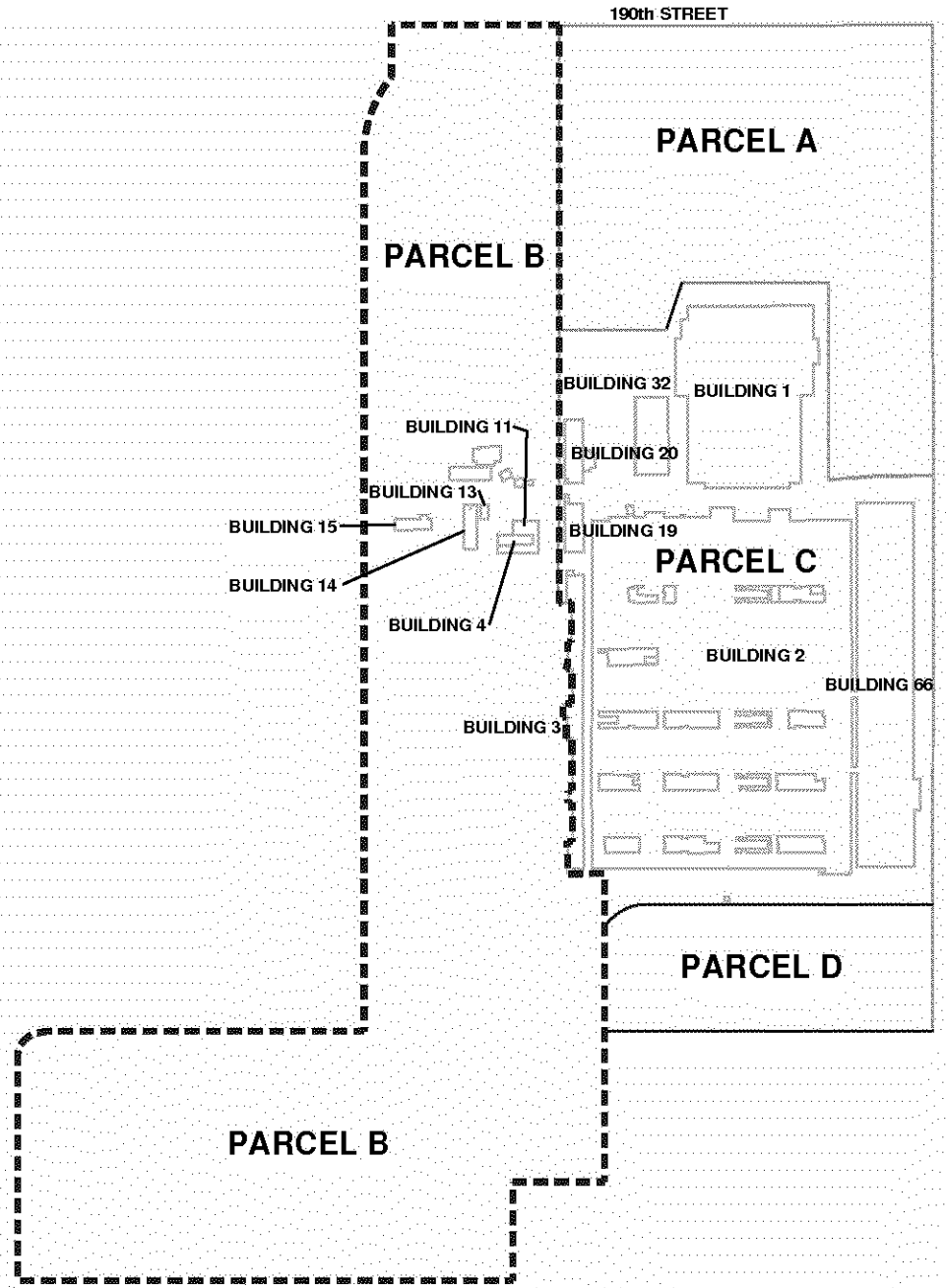

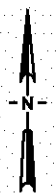

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ALL DIMENSIONS AND LOCATIONS APPROXIMATE

SOURCE: Kennedy/Jenks Consultants, Sampling & Analysis Plan, Boeing Realty Corporation's C-6 Facility-Parcel C, Los Angeles, California, 16 August, 2000

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FIGURE: 2

PARCEL B SITE PLAN

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FIGURE: 3

SURROUNDING PROPERTIES MAP

SCALE: AS SHOWN | PROJECT: 27285-003

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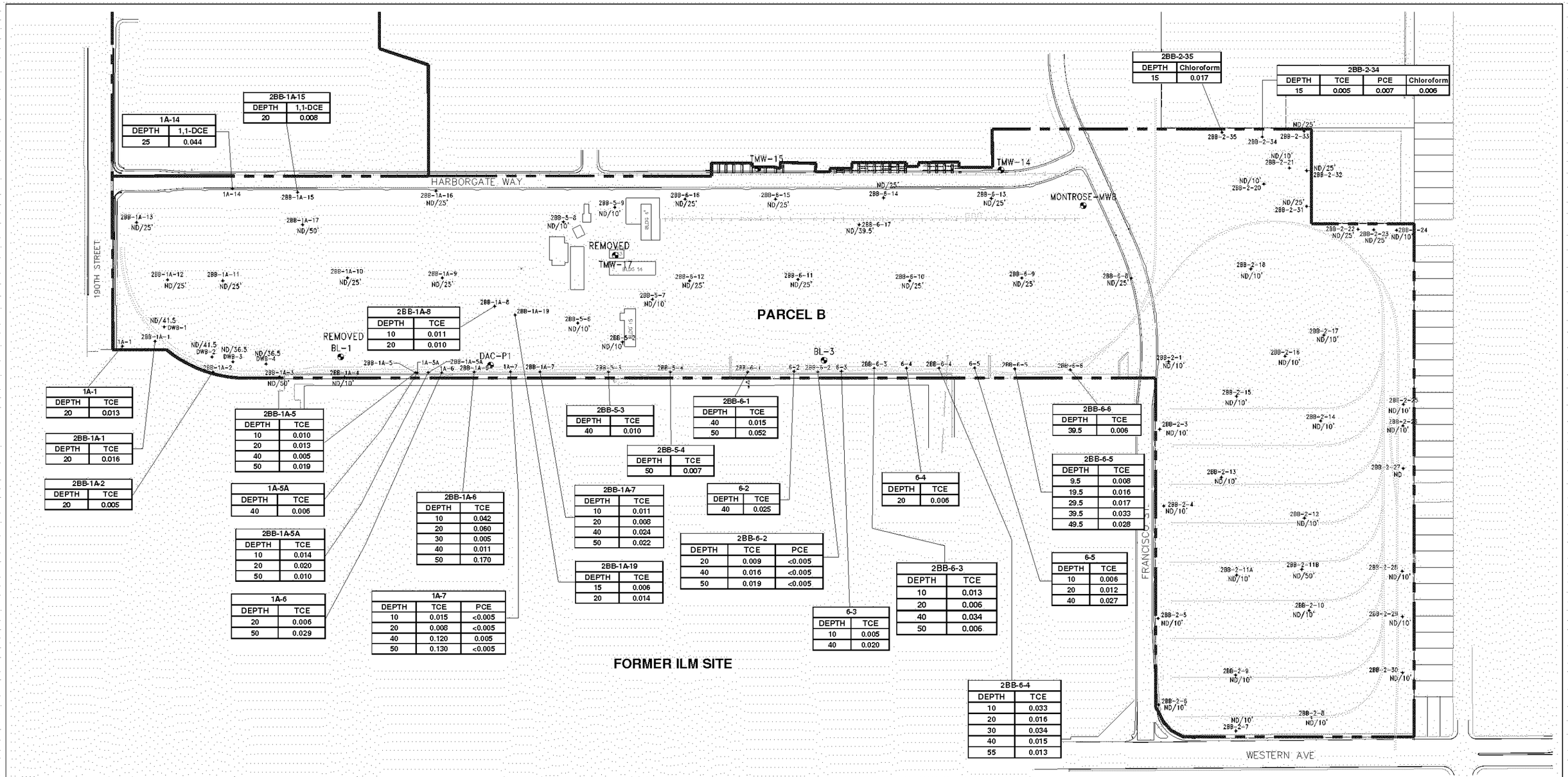

LEGEND

TMW-15	GROUNDWATER MONITORING WELL
	PARCEL BOUNDARY
	BUILDING FOOTPRINTS (FORMER)
ND	LESS THAN METHOD DETECTION LIMIT
ND / 10'	NON DETECTABLE FOR ALL ANALYTES / TOTAL DEPTH SAMPLED
1A-7	SOIL BORING
	DETECTED CONCENTRATIONS IN SOIL SAMPLES (DEPTHS IN FEET)
1,1-DCE	1,1-DICHLOROETHENE
PCE	TETRACHLOROETHENE
TCE	TRICHLOROETHENE

N

0 75 150 300

FEET

ALL DIMENSIONS AND LOCATIONS APPROXIMATE

NOTES: 1. ALL CONCENTRATIONS EXPRESSED AS mg/kg.
2. DATA PRESENTED FOR DEPTHS OF 10 FEET BGS OR GREATER.

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FIGURE: 4

VOC CONCENTRATIONS IN SOIL, PARCEL B

SCALE: AS SHOWN | PROJECT: 27285-003
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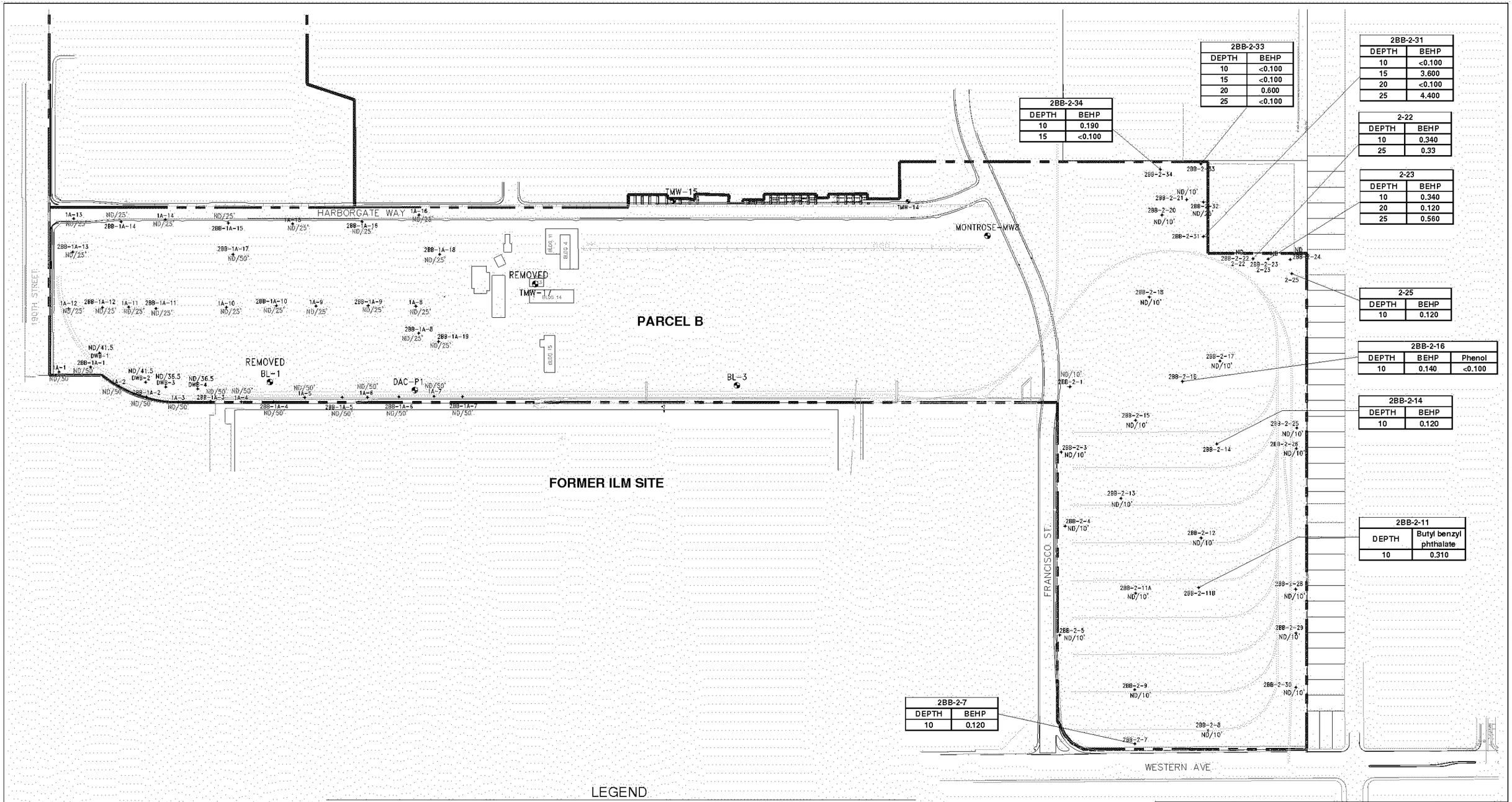

LEGEND

TMW-15	GROUNDWATER MONITORING WELL		DETECTED CONCENTRATIONS IN SOIL SAMPLES (DEPTHS IN FEET)
	PARCEL BOUNDARY		
	BUILDING FOOTPRINTS (FORMER)	ND / 10'	NON DETECTABLE FOR SVOCs / TOTAL DEPTH SAMPLED
ND	LESS THAN METHOD DETECTION LIMIT	ND / 10'	NON DETECTABLE FOR PCBs / TOTAL DEPTH SAMPLED
1A-7	SOIL BORING	BEHP	BIS (2-ETHYLHEXYL) PHTHALATE

NOTES: 1. ALL CONCENTRATIONS EXPRESSED AS mg/kg.
2. DATA PRESENTED FOR DEPTHS OF 10 FEET BGS OR GREATER.

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FIGURE: 5

SVOC AND PCB CONCENTRATIONS IN SOIL, PARCEL B

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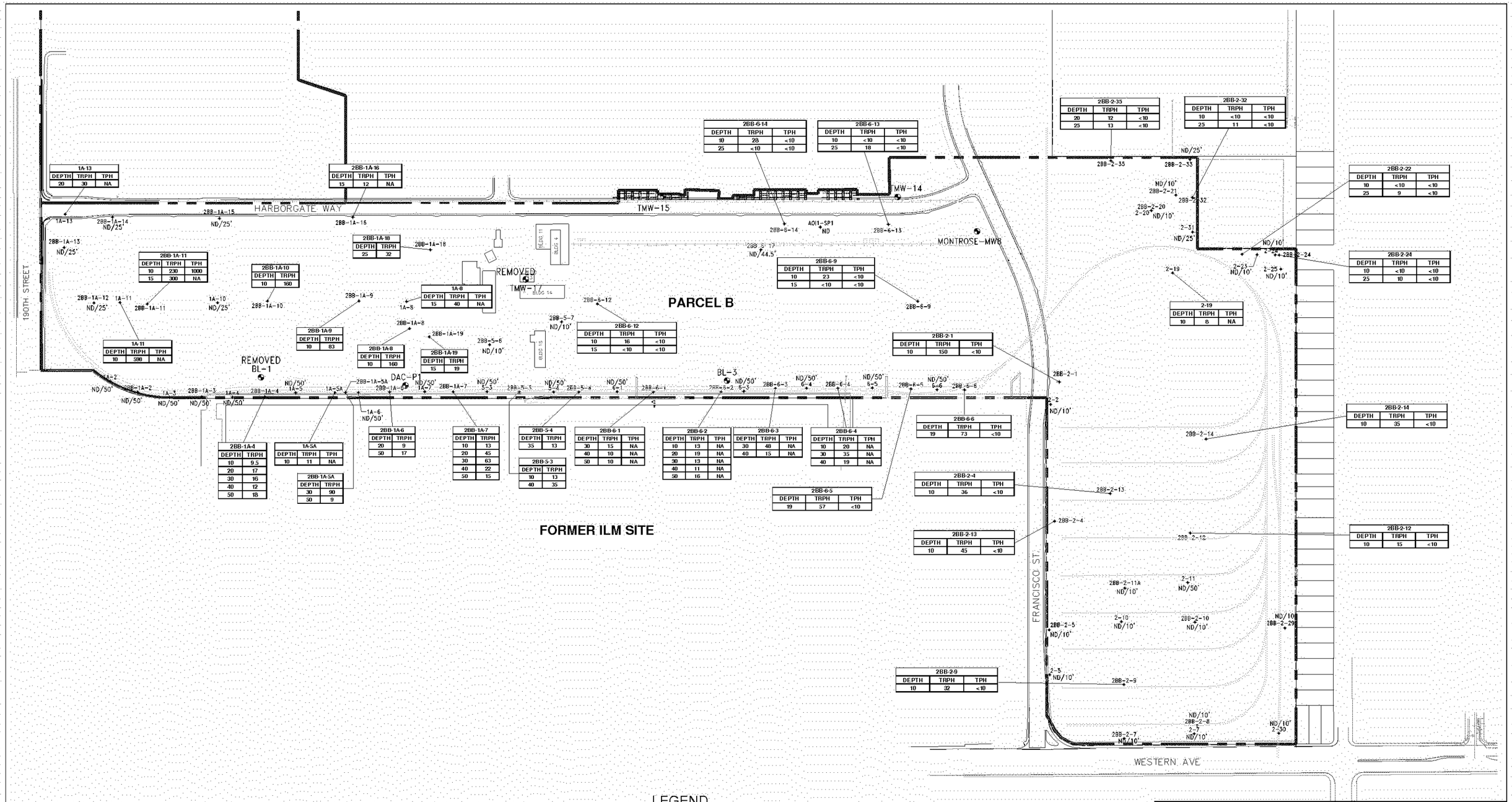

LEGEND

TMW-15	GROUNDWATER MONITORING WELL
	PARCEL BOUNDARY
	BUILDING FOOTPRINTS (FORMER)
ND	LESS THAN METHOD DETECTION LIMIT
ND / 10'	NON DETECTABLE FOR TPH/TRPH / TOTAL DEPTH SAMPLED
1A-7	SOIL BORING
	DETECTED CONCENTRATIONS IN SOIL SAMPLES (DEPTHS IN FEET)
TPH	TOTAL PETROLEUM HYDROCARBONS
TRPH	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

NOTES: 1. ALL CONCENTRATIONS EXPRESSED AS mg/kg.
2. DATA PRESENTED FOR DEPTHS OF 10 FEET BGS OR GREATER.

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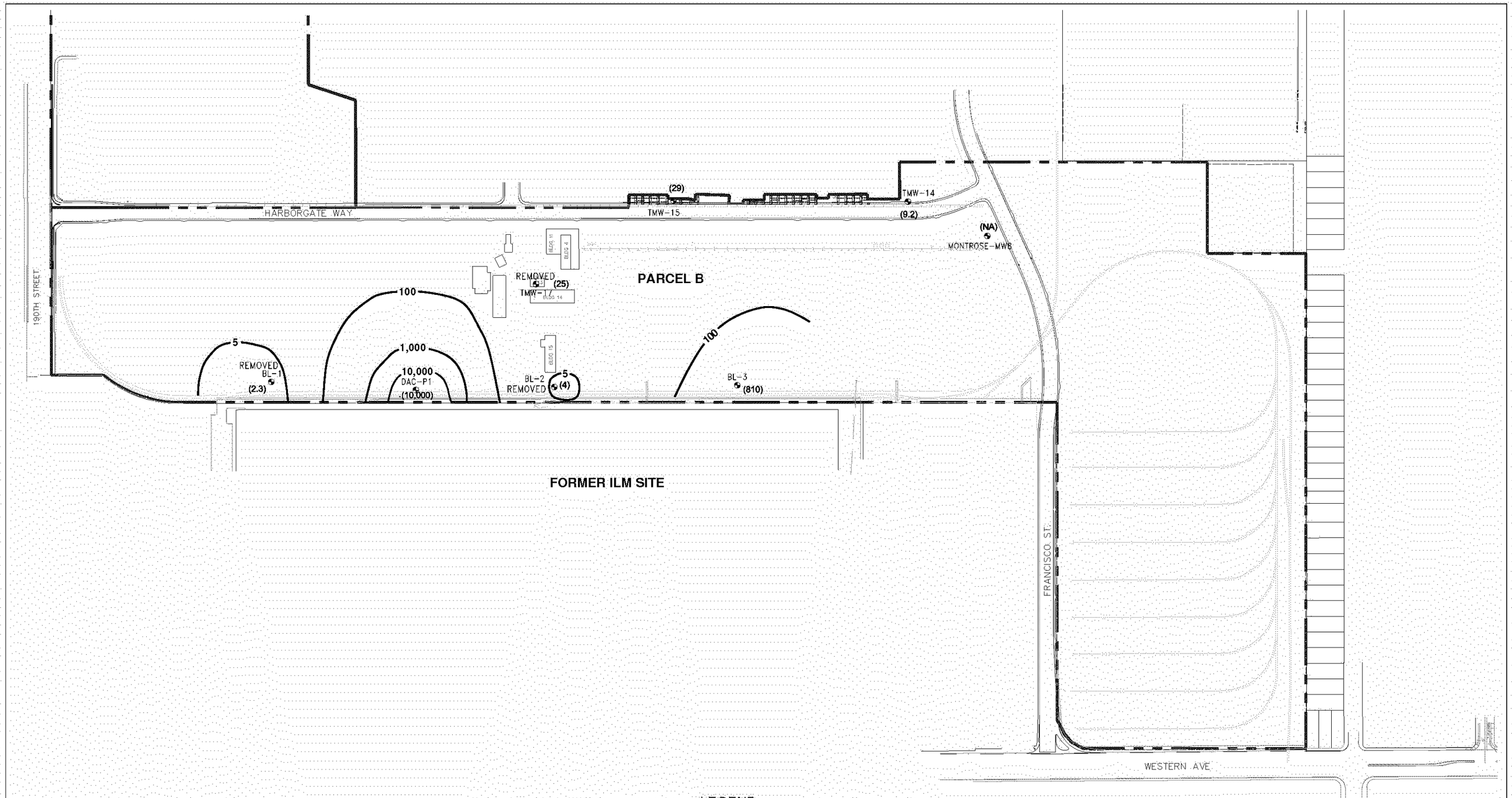
FIGURE: 6

TPH AND TRPH CONCENTRATIONS IN SOIL, PARCEL B

SCALE: AS SHOWN | PROJECT: 27285-003
DRAWN: SAL | REVIEWED: MM | DATE: 21 MARCH 2002



LEGEND

(25)	GROUNDWATER MONITORING WELL AND TCE CONCENTRATIONS
	PARCEL B BOUNDARY
	BUILDING FOOTPRINTS (FORMER)
1,000	TCE ISOCONCENTRATION CONTOUR
NA	NOT ANALYZED

N

0 75 150 300

FEET

ALL DIMENSIONS AND LOCATIONS APPROXIMATE

SOURCE: GROUNDWATER MONITORING REPORT ANNUAL EVENT JANUARY / FEBRUARY, 2001

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NOTE: ALL CONCENTRATIONS EXPRESSED AS ug/L

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FIGURE: 7

TCE CONCENTRATIONS IN SHALLOW GROUNDWATER, PARCEL B

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Appendix A
References

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Appendix B
Parcel B Risk Assessment Discussion and Calculations

PARCEL B RISK ASSESSMENT DISCUSSION AND CALCULATIONS

Additional risk assessment calculations were performed to supplement the initial post-demolition risk assessment previously submitted to the RWQCB and HERD (Integrated 1998b) to evaluate potential the human health risks associated with the various deep soil residual impacts in Parcel B. Human health risks were evaluated for the following additional potential exposure pathways using deep soil investigation results:

- inhalation of VOCs in indoor air from upward VOC vapor migration from groundwater into onsite buildings

- inhalation of VOCs in indoor air due to VOC migration from deep soil leachate migration to groundwater and subsequent VOC vapor migration from groundwater into indoor air

Potential further degradation of groundwater due to chemical leaching from soil to groundwater was also evaluated.

The results of the groundwater quality impact assessment are presented below, followed by the results of the additional human health risk assessment.

GROUNDWATER QUALITY IMPACT ASSESSMENT

The objective of the groundwater quality impact assessment is to evaluate whether existing chemical concentrations in deep soils of Parcel B have the potential to degrade existing groundwater quality. Even though shallow groundwater beneath and in proximity to Parcel B is not used as a domestic water supply, the RWQCB requested, as a conservative measure, that an evaluation be conducted of potential downward chemical migration from soil resulting in possible degradation of the Bellflower aquitard. The Bellflower aquitard is the most shallow water-bearing zone beneath Parcel B. This evaluation conservatively and unrealistically assumes that the Bellflower aquitard is a part of the underlying aquifers providing domestic water supply. As described below, the assessment was conducted by further assuming a conservative scenario regarding chemical migration and mixing in groundwater following approved EPA and RWQCB methodology and assumptions.

The maximum COPC concentrations in soil were compared to site-specific soil screening levels (SSLs) derived from California drinking water standards, specifically primary or secondary MCLs. Initial site-specific SSLs were derived using the following formula presented in Section 2.5 of the EPA document entitled *Soil Screening Guidance: Technical Background Document (TBD),* dated July 1996:

$$\text{Initial SSL} = \text{MCL}\ [(K_{oc} * f_{oc}) + ((O_w + O_a * H')/P_b)] \qquad \text{(Equation 1)}$$

Where:

Initial SSL = soil screening level, mg/kg;
MCL = maximum contaminant level, mg/L;
K_{oc} = soil organic carbon-water partition coefficient, L/kg;
f_{oc} = organic carbon content of soil, kg/kg;
O_w = water-filled soil porosity, L_{water}/L_{soil};
O_a = air-filled soil porosity, L_{air}/L_{soil};
H' = Henry's law constant, dimensionless; and
P_b = dry soil bulk density, kg/L.

Site-specific geotechnical parameters are presented in Table B-1. The above equation is a partitioning formula, which does not account for chemical attenuation during migration in soil or mixing with groundwater. To better represent contaminant migration in the soil column, an attenuation factor of 2 was applied to the initial SSLs for VOCs, an attenuation factor of 296 for was applied to the initial SSL for bis(2-ethylhexyl)phthalate, and attenuation factor of 39 was applied to the initial SSL for arsenic. The attenuation factor for VOCs was derived using Table 5-14: Average Attenuation Factor for Different Distance above Ground Water and Lithology presented in the RWQCB's May 1996 *Interim Site Assessment & Cleanup Guidebook* (the Guidebook), and the attenuation factors for bis(2-ethylhexyl)phthalate and arsenic were derived using the formulas presented in Appendix A of that same document. These attenuation factors were derived assuming site-specific average soil particle size distributions of 51 percent sand, 41 percent silt, and 8 percent clay (Table B-2), and a distance of 15 feet from soil impacts to the groundwater table. This distance is considered to be appropriate because it represents the depth at which the deepest soil samples were collected, and thus the closest distance from collected samples to groundwater. Groundwater at the site is approximately 65 feet bgs, and the deepest soil samples were collected from a depth of approximately 50 feet bgs.

An EPA default dilution attenuation factor (DAF) of 20 was applied to the initial SSL to account for limited groundwater mixing. This EPA default value is presented in the above-referenced July 1996 EPA document, and was used by EPA to develop generic SSLs. The resulting site-specific SSL is equal to the initial SSL (assuming no soil attenuation or groundwater mixing) multiplied by the product of a soil attenuation factor (e.g. 2 for VOCs) and a groundwater mixing factor of 20.

The calculation of site-specific SSLs for COPCs that have promulgated MCLs is presented in Table B-3 and B-4. A comparison of the calculated site-specific SSLs with the maximum COPC concentrations in soil is also presented in Table B-3.

The maximum chemical concentrations in onsite soil do not exceed the site-specific groundwater protection concentrations (i.e., site-specific SSLs), with the exception of TCE. TCE concentrations greater than the SSL were only detected at depths between 40 and 50 feet bgs, along the western boundary of Parcel B, which is adjacent to the ILM site. The presence of TCE in this portion of Parcel B is likely due to known VOC impacted groundwater migration from the ILM site east of Parcel B. In addition, as indicated below, the estimated maximum groundwater concentration due to leaching of TCE from soil to groundwater is less than the existing TCE concentration in groundwater in the nearest onsite well (DAC-P1). Thus, leaching of TCE from deep soil to groundwater would not result in further degradation of groundwater quality.

INHALATION OF INDOOR AIR – VOC VAPOR MIGRATION FROM GROUNDWATER INTO INDOOR AIR

Human health risk associated with VOC vapor migration from groundwater into onsite buildings and subsequent inhalation of indoor air was calculated for the onsite commercial/industrial worker. These risks were estimated using the County of San Diego Department of Environmental Health (DEH) vapor migration model and the highest VOC concentrations in groundwater obtained from the most recent samples (collected in 2001) from groundwater monitoring wells DAC-P1, TMW-14, TMW-15, WCC-10S, and BL-01 through BL-03. The model results are presented in Appendix C, and a summary of the results is presented in Table B-5.

As shown in Table B-5, both the estimated excess cancer risk and estimated hazard index are orders of magnitude less than the OEHHA-approved acceptable target risk levels of 1.0×10^{-5} and 1.0, respectively. Thus, the existing VOC concentrations in groundwater beneath Parcel B do not pose an indoor air health risk greater than the OEHHA-approved risk levels.

INHALATION OF INDOOR AIR – VOC MIGRATION FROM SOIL LEACHATE MIGRATION TO GROUNDWATER AND SUBSEQUENT VOC VAPOR MIGRATION FROM GROUNDWATER INTO INDOOR AIR

VOCs in soil may leach into groundwater and subsequently volatilize from groundwater and, through upward diffusion, migrate through the soil column into indoor air. The SSL equation (Equation 1) was used to estimate maximum VOC concentrations in pore water by substituting the SSL parameter with maximum onsite soil concentrations in the equation to derive the maximum pore water concentration instead of the MCL:

$$C_{pw} = C_s / [(K_{oc} * f_{oc}) + ((O_w + O_a*H')/P_b)] \qquad \text{(Equation 2)}$$

Where:

C_{pw} = maximum VOC concentration in pore water, mg/L; and
C_s = maximum VOC concentration in soil, mg/kg.

The estimated maximum VOC concentration in groundwater was then derived by applying the soil attenuation factor of 2 and the EPA DAF of 20 to the maximum pore water concentration. The resulting estimated maximum VOC concentrations in groundwater are presented in Table B-6. Human health risk associated with the inhalation of vapors in buildings resulting from migration of VOC vapors from the estimated maximum VOC concentrations in groundwater were calculated for the onsite commercial/industrial worker using the DEH vapor migration model. The model results are presented in Appendix C, and a summary of the results is presented in Table B-7. As shown in Table B-7, both the calculated excess cancer risk and hazard index are orders of magnitude less than the risk thresholds of 1.0×10^{-5} and 1.0, respectively. Thus, vapor migration from groundwater due to VOC leaching to groundwater does not pose an indoor air health risk greater than the OEHHA-approved risk levels.

In addition, a simple comparison between estimated maximum TCE concentrations in groundwater, due to chemical leaching to groundwater, and measured TCE concentrations in groundwater was conducted to assess whether the existing TCE concentrations in soil may further degrade existing groundwater quality. As shown in Table B-8, the estimated maximum groundwater concentration for TCE is less than the most recently measured TCE concentration in the groundwater sample collected from the monitoring well situated closest to the boring with the greatest onsite deep soil concentration of TCE.

CUMULATIVE HUMAN HEALTH RISKS

As indicated in the previous sections, the following additional potential exposure pathways were evaluated using the deep soil investigation results:

- inhalation of VOCs in indoor air from upward VOC vapor migration from groundwater into onsite buildings

- inhalation of VOCs in indoor air due to VOC migration from deep soil leachate migration to groundwater and subsequent VOC vapor migration from groundwater into indoor air

The risks associated with the above-listed exposure pathways, and the estimated risks to potential onsite receptors as presented in the post-demolition risk assessment are summarized in Table B-9. As shown in Table B-9, adding the estimated risks from the above-listed pathways to the estimated risks to the potential onsite receptors do not result in risks greater than the OEHHA-approved risk levels.

Table B-1. Site-specific Geotechnical Parameters at the BRC Former C-6 Facility

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (kg/L)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f_{oc} (fraction by weight)
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	1.35	4.4	0.51	0.45	0.06	230	0.0002
EIA29176-015 (D-29-50)	1/29/2001	50	Fine sand	1.36	19.5	0.49	0.22	0.26	560	0.0006
EIA29176-024 (I-25-50)	1/29/2001	50	Silt	1.34	24.3	0.51	0.18	0.32	470	0.0005
Average (depths 50 to 65 feet bgs)				1.35		0.50	0.28	0.22		0.0004

It is assumed that the 50-foot sample is representative of depths between 50 and 65 feet bgs.

Notes:
The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/1,000,000

G: projects/environmental/boeing/C6/ParcelB/Final/ParcelB-tables 1, 2, 3, 4, 6and 9

Table B-2. Soil Particle Size Distribution at BRC Former C-6 Facility

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Median Grain Size (mm)	Particle Size Distribution, wt. Percent						
					Gravel	Sand Size				Silt	Clay
						Coarse	Medium	Fine	TOTAL		
EIA290176-007 (I-34-50)	1/29/2001	50	Fine sand	0.151	0.00	0.00	0.57	79.33	79.90	17.39	2.71
EIA29176-015 (D-29-50)	1/29/2001	50	Fine sand	0.083	0.00	0.00	3.26	47.93	51.19	39.79	9.01
EIA29176-024 (I-25-50)	1/29/2001	50	Silt	0.027	0.00	0.00	0.04	21.27	21.31	64.99	13.70
Average									**50.80**	**40.72**	**8.47**
Average (depths 50 to 65 feet bgs)									0.51	0.41	0.08

It is assumed that the 50-foot sample is representative of depths between 50 and 65 feet bgs.

G: projects/environmental/boeing/C6/ParcelB/Final/ParcelB-tables 1, 2, 3, 4, 6and 9

Table B-3. Derivation of Soil Attenuation Factor for VOCs and Comparison of Maximum Soil Concentrations to Site-specific SSLs Calculated at 50 Feet Below Ground Surface

CAS No.	Chemical	MCL (mg/L)	K_{oc} [1,2]	f_{oc} [3]	K_d [2,4]	H' [1]	O_w [3]	O_a [3]	P_b [3]	Max. Residual Soil Concentration (mg/kg)	AF for D=15'	Site-specific SSL (mg/kg) at AF = 1	Site-specific SSL (mg/kg) at AF for D=15'	Site-specific SSL (mg/kg) at AF for D=15' and DAF=20	Max > SSL for at AF_T for D=15' and DAF=20?
7440-38-2	Arsenic	5.00E-02	--	4.00E-04	7.90E+02	--	2.20E-01	2.80E-01	1.35E+00	2.50E+01	39	3.95E+01	1.54E+03	3.07E+04	No
117-81-7	Bis(2-ethylhexyl)phthalate	4.00E-03	--	4.00E-04	7.90E+02	--	2.20E-01	2.80E-01	1.35E+00	4.40E+00	296	3.16E+00	9.36E+02	1.87E+04	No
75-35-4	1,1-Dichloroethene (1,1-DCE)	6.00E-03	6.5E+01	4.00E-04	--	1.1E+00	2.20E-01	2.80E-01	1.35E+00	4.40E-02	2	2.50E-03	5.33E-03	1.07E-01	No
127-18-4	Tetrachloroethene (PCE)	5.00E-03	2.7E+02	4.00E-04	--	7.5E-01	2.20E-01	2.80E-01	1.35E+00	5.00E-03	2	2.13E-03	4.54E-03	9.08E-02	No
108-88-3	Toluene	1.50E-01	1.4E+02	5.19E-04	--	2.7E-01	2.20E-01	2.80E-01	1.35E+00	3.00E-03	2	4.37E-02	9.32E-02	1.86E+00	No
79-01-6	Trichloroethene (TCE)	5.00E-03	9.4E+01	4.00E-04	--	4.2E-01	2.20E-01	2.80E-01	1.35E+00	1.70E-01	2	1.44E-03	3.06E-03	6.13E-02	**Yes**

An SSL was not derived for chemicals that do not have promulgated primary MCLs. These chemicals were not included in the assessment of potential degradation to groundwater quality.

AF = Average attenuation factor based on site lithology (distance to groundwater = 15 feet, 51% sand, 41% silt, and 8% clay).

na = not available
K_{oc} = soil organic carbon-water partition coefficient (L/kg)
f_{oc} = site-specific organic carbon content of soil (kg/kg)
K_d = soil-water partition coefficient (L/kg), $K_{oc} \times f_{oc}$
H' = dimensionless Henry's law constant
O_w = site-specific average water-filled porosity (by volume)
O_a = site-specific average air-filled porosity (by volume)
P_b = dry soil bulk density (kg/L)

[1] Obtained from EPA Region 9 preliminary remediation goal (PRG) physical-chemical data for volatile organic compounds, November 2000
[2] Obtained from Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
[3] Site-specific average values
[4] Obtained from EPA Soil Screening Guidance: Technical Background Document (TBD), EPA/540/R-95/128, July 1996, http://www.epa.gov/oerrpage/superfund/resources/soil/toc.htm

Table B-4. Derivation of Non-VOC Site-specific AFt Following RWQCB Guidance (Depths 12 to 65 feet bgs)

CAS No.	Chemical	K_{oc} [1,2,4]	f_{oc} [3]	K_d [2,4]	H' [1]	O_w [3]	O_a [3]	P_b [3]	O_t	AF_{max}	Distance to Groundwater (feet)	AF_D	AF_T	**AF_T**
7440-38-2	Arsenic	--	--	7.9E+02	--	2.20E-01	2.80E-01	1.35E+00	5.00E-01	4849	15	182.45	38.86	39
117-81-7	Bis (2-ethylhexyl)phthalate	1.5E+07	4.0E-04	--	4.2E-06	2.20E-01	2.80E-01	1.35E+00	5.00E-01	37065	15	1390.55	296.19	296

na = not available

An AF_T was not derived for chemicals that do not have promulgated primary MCLs. These chemicals were not included in the assessment of potential furthe degradation to groundwater quality.

AFT were calculated assuming that the depth between chemical impacts and groundwater is 15 feet and that the soil within this portion of the soil column is comprised of 51% sand, 41% silt, and 8% clay.

K_{oc} = soil organic carbon-water partition coefficient (L/kg)

f_{oc} = site-specific organic carbon content of soil (kg/kg)

K_d = soil-water partition coefficient (L/kg), $K_{oc} \times f_{oc}$

H' = dimensionless Henry's law constant

O_w = site-specific average water-filled porosity (by volume)

O_a = site-specific average air-filled porosity (by volume)

Ot = site-specific average total porosity (by volume)

P_b = dry soil bulk density (kg/L)

[1] Obtained from EPA Region 9 preliminary remediation goal (PRG) physical-chemical data for volatile organic compounds, November 2000

[2] Obtained from Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf

[3] Site-specific average values

[4] Obtained from EPA Soil Screening Guidance: Technical Background Document (TBD), EPA/540/R-95/128, July 1996, http://www.epa.gov/oerrpage/superfund/resources/soil/toc.htm

Table B-5
Summary of Risk Associated with VOC Vapor Migration from Groundwater

Chemical	Closest Groundwater Monitoring Well	Most Recent Date Sampled	Groundwater Monitoring Well Concentration (mg/L)	Excess Cancer Risk	Estimated Hazard Index
Benzene	BL-01	July 17, 2001	0.00081	1.4×10^{-10}	0.00000023
Carbon disulfide	DAC-P1	Jan. 18, 2001	0.370	No Slope Factor	0.000052
Carbon tetrachloride	TMW-14	July 18, 2001	0.0015	1.8×10^{-9}	0.0000029
Chloroform	TMW-15	July 19, 2001	0.0051	1.2×10^{-10}	0.00000021
1,1-DCA	BL-01	July 17, 2001	0.00035	2.8×10^{-12}	0.000000010
1,1-DCE	TMW-15	July 19, 2001	0.00058	8.4×10^{-10}	0.00000067
Cis-1,2-DCE	BL-01	July 17, 2001	0.012	No Slope Factor	0.0000036
Ethylbenzene	TMW-15	July 19, 2001	0.00023	No Slope Factor	0.0000000023
Isopropyl-benzene	BL-01	July 17, 2001	0.00032	No Slope Factor	0.0000025
Methylene chloride	BL-01	July 17, 2001	0.006	1.6×10^{-11}	0.00000012
Methyl ethyl ketone	TMW-15	July 19, 2001	0.0056	No Slope Factor	0.00000000091
PCE	BL-03	Jan. 18, 2001	0.025	2.4×10^{-9}	0.000032
Toluene	TMW-15	July 19, 2001	0.017	No Slope Factor	0.0000011
TCE	DAC-P1	Jan. 18, 2001	10	2.8×10^{-7}	0.00045
1,2,4-Trimethyl-benzene	TMW-15	July 19, 2001	0.00043	No Slope Factor	0.0000010
Vinyl chloride	BL-01	July 17, 2001	0.003	8.2×10^{-9}	0.000012
Xylenes	TMW-15	July 19, 2001	0.0014	1.3×10^{-10}	0.0000018
Total				2.9×10^{-7}	0.00056

Table B-6. Derivation of Estimated Maximum VOC Concentrations in Groundwater at Parcel B Using a Site-specific SSL Equation

CAS No.	Chemical	Max. Residual Soil Concentration (mg/kg)	K_{oc} [1]	f_{oc} [2]	K_d [3]	H' [1]	O_w [2]	O_a [2]	P_b [2]	Pore Water Conc. (mg/L)	Groundwater Conc. (mg/L) = Pore Water Conc. / AF / DAF
75-35-4	1,1-DCE	4.40E-02	6.5E+01	4.00E-04	--	1.1E+00	2.20E-01	2.80E-01	1.35E+00	1.1E-01	2.6E-03
127-18-4	PCE	5.00E-03	2.7E+02	4.00E-04	--	7.5E-01	2.20E-01	2.80E-01	1.35E+00	1.2E-02	2.9E-04
108-88-3	Toluene	3.00E-03	1.4E+02	4.00E-04	--	2.7E-01	2.20E-01	2.80E-01	1.35E+00	1.1E-02	2.7E-04
79-01-6	TCE	1.70E-01	9.4E+01	4.00E-04	--	4.2E-01	2.20E-01	2.80E-01	1.35E+00	5.9E-01	1.5E-02

K_{oc} = soil organic carbon-water partition coefficient (L/kg)

f_{oc} = organic carbon content of soil (kg/kg)

K_d = soil-water partition coefficient (L/kg), K_{oc} x f_{oc}

H' = dimensionless Henry's law constant

O_w = site-specific average water-filled porosity (by volume)

O_a = site-specific average air-filled porosity (by volume)

P_b = dry soil bulk density (kg/L)

[1] Obtained from EPA Region 9 preliminary remediation goal (PRG) physical-chemical data for volatile organic compounds, November 2000

[2] Site-specific average values

[3] Obtained from EPA Soil Screening Guidance: Technical Background Document (TBD), EPA/540/R-95/128, dated July 1996, http://www.epa.gov/oerrpage/superfund/resources/soil/toc.htm

Table B-7

Summary of Risk Associated with VOC Vapor Migration from Groundwater as a Result of Leachate Migrating into Groundwater

Chemical	Estimated Groundwater Concentration (mg/L)	Excess Cancer Risk	Estimated Hazard Index
1,1-DCE	0.0026	3.8×10^{-9}	0.0000030
PCE	0.00029	2.8×10^{-11}	0.00000037
Toluene	0.00027	No Slope Factor	0.000000017
TCE	0.015	4.2×10^{-10}	0.00000068
Total		4.2×10^{-9}	0.0000041

Table B-8
Comparison of Estimated TCE Concentration in Groundwater to Measured TCE Concentrations in Groundwater

Chemical	Maximum Soil Concen-tration (mg/kg)	Estimated Maximum Potential Groundwater Concentration (mg/L)	Closest Groundwater Monitoring Well	Most Recent Date Sampled	Closest Groundwater Monitoring Well Concentration (mg/L)
TCE	0.17	0.015	DAC-P1	1/18/2001	10

Table B-9. Summary of Cumulative Risks

	Onsite Construction Worker	Onsite Commercial/Industrial Worker	Onsite DTSC Commercial/Industrial Worker
Hazard Index			
Previously Estimated	0.028	0.000016	0.000016
Vapor Migration from Groundwater	NA	0.00056	0.00056
Vapor Migration from Deep Soil Leachate and Subsequent Volatilization from Groundwater	NA	0.0000041	0.0000041
Total	0.028	0.00058	0.00058
Excess Cancer Risk			
Previously Estimated	1.7E-07	2.8E-11	2.8E-11
Vapor Migration from Groundwater	NA	2.9E-07	2.9E-07
Vapor Migration from Deep Soil Leachate and Subsequent Volatilization from Groundwater	NA	4.2E-09	4.2E-09
Total	1.7E-07	2.9E-07	2.9E-07

NA = Not applicable

Appendix C
Parcel B Vapor Migration Model Results

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
MIGRATION FROM GROUNDWATER
BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L)	Cancer Risk	Hazard Index
71-43-2	Benzene	0.81	1.37E-10	0.00000022
75-15-0	Carbon disulfide	370	No Slope Factor	0.000052
56-23-5	Carbon tetrachloride	1.5	1.76E-09	0.0000029
71-55-6	Chloroform	5.1	1.2E-10	0.00000021
75-34-3	1,1-Dichloroethaene (1,1-DCA)	0.35	2.84E-12	0.000000010
75-34-3	1,1-Dichloroethylene (1,1-DCE)	0.58	8.4E-10	0.00000067
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	12	No Slope Factor	0.0000035
100-41-4	Ethylbenzene	0.23	No Slope Factor	0.0000000023
98-82-8	Isopropyl-benzene (cumene, 1-methyethyl b	0.32	No Slope Factor	0.0000025
75-09-2	Methylene Chloride	6	1.6E-11	0.00000012
78-93-3	Methyl Ethyl Ketone	5.6	No Slope Factor	0.00000000091
79-01-6	Tetrachloroethylene (PCE)	25	2.4E-09	0.000032
108-88-3	Toluene	17	No Slope Factor	0.0000011
79-01-6	Trichloroethlyene (TCE)	10,000	2.8E-07	0.00045
95-63-6	1,2,4 - Trimethylbenzene	0.43	No Slope Factor	0.0000010
75-01-4	Vinyl chloride	3	8.21E-09	0.000011
1330-20-7	Xylenes	1.4	1.33E-10	0.0000018
	Total		2.9E-07	0.00056

G: projects/environmental/boeing/C6/ParcelB/Final/Appendix C - groundwater risk assess calc tables_secondtable

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.80E+04	mg/mole
Vapor pressure	VP	=	1.25E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	8.10E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**1.86E-01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	6.20E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**2.48E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.86E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	8.80E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**7.06E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**2.39E-05**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**1.18E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**1.18E-07**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**1.37E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**3.85E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	3.85E-09	mg/kg-day
Reference dose	RfD	=	1.71E-02	mg/kg-day
Hazard Index	**HI**	=	**2.25E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	1.37E-09	mg/kg-day
Slope factor (potency)	SF	=	1.00E-01	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**1.37E-10**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon disulfide

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.60E+04	mg/mole
Vapor pressure	VP	=	4.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	3.70E+02	ug/l
Henry's Law Constant	H	=	1.20E+00	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**4.44E+02**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.20E+00	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	4.60E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**1.84E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.44E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	1.00E-01	cm2/sec
Effective diffusion coefficient	**D_e**	=	**8.03E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**6.48E-02**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**3.20E-04**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**3.20E-04**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**3.72E-06**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.04E-05**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.04E-05	mg/kg-day
Reference dose	RfD	=	2.00E-01	mg/kg-day
Hazard Index	**HI**	=	**5.22E-05**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	3.72E-06	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon tetrachloride

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.50E+05	mg/mole
Vapor pressure	VP	=	1.51E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.50E+00	ug/l
Henry's Law Constant	H	=	1.20E+00	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**1.80E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.20E+00	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.50E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**6.00E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.80E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.80E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.26E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**2.05E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**1.01E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**1.01E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**1.18E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**3.30E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	3.30E-08	mg/kg-day
Reference dose	RfD	=	1.14E-02	mg/kg-day
Hazard Index	**HI**	=	**2.89E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	1.18E-08	mg/kg-day
Slope factor (potency)	SF	=	1.50E-01	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**1.76E-09**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Chloroform

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.59E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	5.10E+00	ug/l
Henry's Law Constant	H	=	1.50E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**7.65E-01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.50E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	5.30E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**2.12E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.65E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	1.00E-01	cm2/sec
Effective diffusion coefficient	**D_e**	=	**8.03E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**1.12E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**5.51E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00	m
Wind speed	u	=	0.00E+00	m/hr
Height of building openings (or height of breathing zone)	h	=	0.00E+00	m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**

C. TOTAL INDOOR AIR CONCENTRATION C_t = **5.51E-07** **mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**6.41E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.80E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.80E-08	mg/kg-day
Reference dose	RfD	=	8.60E-02	mg/kg-day
Hazard Index	**HI**	=	**2.09E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	6.41E-09	mg/kg-day
Slope factor (potency)	SF	=	1.90E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**1.22E-10**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	3.08E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	3.50E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**8.05E-02**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	5.30E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**2.12E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 8.05E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.40E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**5.94E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**8.69E-06**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**4.29E-08**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**4.29E-08**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.99E-10**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.40E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.40E-09	mg/kg-day
Reference dose	RfD	=	1.40E-01	mg/kg-day
Hazard Index	**HI**	=	**1.00E-08**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.99E-10	mg/kg-day
Slope factor (potency)	SF	=	5.70E-03	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**2.84E-12**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	5.80E-01	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**6.38E-01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	6.50E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**2.60E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.38E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**7.22E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**8.38E-05**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**4.14E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**4.14E-07**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.81E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.35E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.35E-08	mg/kg-day
Reference dose	RfD	=	2.00E-02	mg/kg-day
Hazard Index	**HI**	=	**6.74E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.81E-09	mg/kg-day
Slope factor (potency)	SF	=	1.75E-01	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**8.41E-10**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	2.40E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.20E+01	ug/l
Henry's Law Constant	H	=	1.70E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**2.04E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.70E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	3.60E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**1.44E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.04E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.40E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**5.94E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**2.20E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**1.09E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**1.09E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**1.26E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**3.55E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	3.55E-08	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	**HI**	=	**3.55E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	1.26E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.30E-01	ug/l
Henry's Law Constant	H	=	3.20E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**7.36E-02**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	3.20E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.00E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**8.00E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.36E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.50E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.02E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**8.05E-06**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**3.98E-08**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**3.98E-08**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.62E-10**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.30E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.30E-09	mg/kg-day
Reference dose	RfD	=	5.71E-01	mg/kg-day
Hazard Index	**HI**	=	**2.27E-09**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.62E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Isopropyl-benzene (cumene, 1-methyethyl benzene)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.92E-03	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	3.20E-01	ug/l
Henry's Law Constant	H	=	4.90E+01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**1.57E+01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	4.90E+01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.20E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**8.80E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.57E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.50E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.02E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**1.72E-03**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**8.47E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**8.47E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**9.85E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**2.76E-07**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	2.76E-07	mg/kg-day
Reference dose	RfD	=	1.10E-01	mg/kg-day
Hazard Index	**HI**	=	**2.51E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	9.85E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methylene Chloride

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	5.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	6.00E+00	ug/l
Henry's Law Constant	H	=	9.00E-02	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**5.40E-01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	9.00E-02	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.00E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**4.00E-02**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 5.40E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	1.00E-01	cm2/sec
Effective diffusion coefficient	**D_e**	=	**8.03E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**7.88E-05**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**3.89E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00	m
Wind speed	u	=	0.00E+00	m/hr
Height of building openings (or height of breathing zone)	h	=	0.00E+00	m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**

C. TOTAL INDOOR AIR CONCENTRATION C_t = **3.89E-07** **mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.52E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.27E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.27E-08	mg/kg-day
Reference dose	RfD	=	1.10E-01	mg/kg-day
Hazard Index	**HI**	=	**1.15E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.52E-09	mg/kg-day
Slope factor (potency)	SF	=	3.50E-03	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**1.58E-11**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.20E+04	mg/mole
Vapor pressure	VP	=	1.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	5.60E+00	ug/l
Henry's Law Constant	H	=	1.10E-03	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**6.16E-03**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.10E-03	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	4.50E+00	cm3/gm
Soil/water distribution coef.	K_d	=	**1.80E-02**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.16E-03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**7.22E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**8.09E-07**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**3.99E-09**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**3.99E-09**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.64E-11**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.30E-10**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.30E-10	mg/kg-day
Reference dose	RfD	=	1.43E-01	mg/kg-day
Hazard Index	**HI**	=	**9.12E-10**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.64E-11	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.50E+01	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**1.88E+01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**1.08E+00**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.88E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**5.78E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**1.97E-03**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**9.72E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**9.72E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**1.13E-07**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**3.17E-07**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	3.17E-07	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	**HI**	=	**3.17E-05**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	1.13E-07	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**2.37E-09**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.70E+01	ug/l
Henry's Law Constant	H	=	2.70E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**4.59E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	2.70E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.40E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**5.60E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.59E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	8.70E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.98E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**5.82E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**2.88E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**2.88E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**3.34E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**9.38E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	9.38E-08	mg/kg-day
Reference dose	RfD	=	8.57E-02	mg/kg-day
Hazard Index	**HI**	=	**1.09E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	3.34E-08	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethlyene (TCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.00E+04	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**4.20E+03**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	9.40E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**3.76E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 4.20E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.90E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.34E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**4.84E-01**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**2.39E-03**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**2.39E-03**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**2.78E-05**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**7.79E-05**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	7.79E-05	mg/kg-day
Reference dose	RfD	=	1.71E-01	mg/kg-day
Hazard Index	**HI**	=	**4.55E-04**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	2.78E-05	mg/kg-day
Slope factor (potency)	SF	=	1.00E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**2.78E-07**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2,4 - Trimethylbenzene

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.76E-03	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	4.30E-01	ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**9.89E-02**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	3.70E+03	cm3/gm
Soil/water distribution coef.	K_d	=	**1.48E+01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 9.89E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.50E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.02E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**1.08E-05**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**5.34E-08**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**5.34E-08**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**6.21E-10**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.74E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.74E-09	mg/kg-day
Reference dose	RfD	=	1.70E-03	mg/kg-day
Hazard Index	**HI**	=	**1.02E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	6.21E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl chloride

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	6.30E+04	mg/mole
Vapor pressure	VP	=	3.50E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	3.00E+00	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**3.30E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.90E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**7.60E-02**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 3.30E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	1.10E-01	cm2/sec
Effective diffusion coefficient	**D_e**	=	**8.83E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**5.29E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**2.61E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**2.61E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**3.04E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**8.53E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	8.53E-08	mg/kg-day
Reference dose	RfD	=	7.43E-03	mg/kg-day
Hazard Index	**HI**	=	**1.15E-05**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	3.04E-08	mg/kg-day
Slope factor (potency)	SF	=	2.70E-01	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**8.21E-09**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.40E+00	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**1.05E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**1.08E+00**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 1.05E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**5.78E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**1.10E-04**	**mg/m2-hour**

Risk Calculations Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**5.45E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**5.45E-07**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**6.33E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.78E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.78E-08	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	**HI**	=	**1.78E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	6.33E-09	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**1.33E-10**	

CHEMICAL PARAMETERS

		MW (mg/mole)		H' (dimensionless)		Da (cm^2/sec)		VP (atm)	Temp. (°C)		K_{oc} (cm^3/g)		Water Solubility (mg/L-water)		CSF (inh) (mg/kg-day)[1]		Chronic RfD (inh) (mg/kg-day)	
CAS No.																		
71-43-2	Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	a	1.2E-01	25	b	6.2E+01	a	1.8E+03	a	1.00E-01		1.71E-02	
75-15-0	Carbon disulfide	7.6E+04	a	1.2E+00	a	1.0E-01	a	4.7E-01	25	b	4.6E+01	a	1.2E+03	a	0.00E+00		2.00E-01	
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	a	1.5E-01	25	b	1.5E+02	a	7.9E+02	a	1.50E-01		1.14E-02	
67-66-3	Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	a	2.6E-01	25	b	5.3E+01	a	7.9E+03	a	1.9E-02	c	8.6E-02	e
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	a	3.1E-01	25	b	5.3E+01	a	5.1E+03	a	5.70E-03		1.40E-01	
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	a	7.8E-01	25	b	6.5E+01	a	2.3E+03	a	1.75E-01		2.00E-02	
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	a	2.4E-04	20	b	3.6E+01	a	3.5E+03	a	0.00E+00		1.00E-02	
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	a	1.3E-02	25	b	2.0E+02	a	1.7E+02	a	0.00E+00		5.71E-01	
98-82-8	Isopropyl-benzene (cumene, 1-methyethyl benzene)	1.2E+05	a	4.9E+01	a	7.5E-02	a	5.9E-03	25	b	2.2E+02	a	6.1E+01	a	0.00E+00		1.10E-01	
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	a	5.7E-01	25	b	1.0E+01	a	1.3E+04	a	3.5E-03	c	1.1E-01	e
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	a	1.2E-01	25	b	4.5E+00	a	2.7E+05	a	0.00E+00		1.43E-01	
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	a	2.4E-02	25	b	2.7E+02	a	2.0E+02	a	2.1E-02	c	1.0E-02	e
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	a	3.7E-02	25	b	1.4E+02	a	5.3E+02	a	0.00E+00		8.57E-02	
79-01-6	Trichloroethlyene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	a	7.6E-02	20	b	9.4E+01	a	1.1E+03	a	1.00E-02		1.71E-01	
95-63-6	1,2,4 - Trimethylbenzene	1.2E+05	a	2.3E-01	a	7.5E-02	a	2.8E-03	25	b	3.7E+03	a	2.6E-01	a	0.00E+00		1.70E-03	
75-01-4	Vinyl chloride	6.3E+04	a	1.1E+00	a	1.1E-01	a	3.5E+00	25	b	1.9E+01	a	2.8E+03	a	2.70E-01		7.43E-03	
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	a	1.1E-02	25	b	2.0E+02	a	1.6E+02	a	0.00E+00		2.00E-01	

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html
c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, http://www.arb.ca.gov/ab2588/riskassess.htm

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index.asp
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, http://www.arb.ca.gov/ab2588/riskassess.htm
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF VAPOR MIGRATION RESULTS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
MIGRATION FROM GROUNDWATER AFTER CHEMICAL LEACHING TO GROUNDWATER
BRC Former C-6 Facility, Los Angeles, California

Groundwater

CAS No.	Chemical	Maximum Concentration in Groundwater (ug/L greater that 12 feet)	Cancer Risk	Hazard Index
75-35-4	1,1-Dichloroethylene (1,1-DCE)	2.6	3.8E-09	0.0000030
127-18-4	Tetrachloroethylene (PCE)	0.29	2.8E-11	0.00000037
108-88-3	Toluene	0.27	No Slope Factor	0.000000017
79-01-6	Trichloroethlyene (TCE)	15	4.2E-10	0.00000068
	Total		4.2E-09	0.0000041

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.60E+00	ug/l
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**2.86E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	6.50E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**2.60E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.86E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	9.00E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**7.22E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**3.75E-04**	**mg/m2-hour**

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**1.85E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**1.85E-06**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**2.16E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**6.05E-08**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	6.05E-08	mg/kg-day
Reference dose	RfD	=	2.00E-02	mg/kg-day
Hazard Index	**HI**	=	**3.02E-06**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	2.16E-08	mg/kg-day
Slope factor (potency)	SF	=	1.75E-01	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**3.77E-09**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.90E-01	ug/l
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**2.18E-01**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	2.70E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**1.08E+00**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 2.18E-01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.20E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**5.78E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**2.28E-05**	**mg/m2-hour**

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**1.13E-07**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**1.13E-07**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**1.31E-09**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**3.68E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	3.68E-09	mg/kg-day
Reference dose	RfD	=	1.00E-02	mg/kg-day
Hazard Index	**HI**	=	**3.68E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	1.31E-09	mg/kg-day
Slope factor (potency)	SF	=	2.10E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**2.75E-11**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.20E+04	mg/mole
Vapor pressure	VP	=	3.74E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	2.70E-01	ug/l
Henry's Law Constant	H	=	2.70E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**7.29E-02**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	2.70E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	1.40E+02	cm3/gm
Soil/water distribution coef.	K_d	=	**5.60E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 7.29E-02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	8.70E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.98E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**9.25E-06**	**mg/m2-hour**

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**4.57E-08**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**
C. TOTAL INDOOR AIR CONCENTRATION	**C_t**	=	**4.57E-08**	**mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**5.31E-10**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.49E-09**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.49E-09	mg/kg-day
Reference dose	RfD	=	8.57E-02	mg/kg-day
Hazard Index	**HI**	=	**1.74E-08**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	5.31E-10	mg/kg-day
Slope factor (potency)	SF	=	0.00E+00	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**No Slope Factor**	

Risk Calculations Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethlyene (TCE)

Variable Descriptions				Units
CALCULATION OF SOIL GAS CONCENTRATION				
A. SOURCE - Free Product/Soil>100mg/kg.				
Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	**C_{sg}(fp)**	=	**0.00E+00**	**mg/m3**
B. SOURCE - Groundwater				
Water contamination level	C_w	=	1.50E+01	ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	**C_{sg}(gw)**	=	**6.30E+00**	**mg/m3**
C. SOURCE - Soil < 100 mg/kg				
Soil contamination level	C_t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ_b	=	1.50E+00	gm/cc
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Water-filled porosity	θ_w	=	1.50E-01	dimensionless
Weight fraction of organic carbon	f_{oc}	=	4.00E-03	dimensionless
Organic carbon partition coefficient	K_{oc}	=	9.40E+01	cm3/gm
Soil/water distribution coef.	K_d	=	**3.76E-01**	cm3/gm
Calculated soil gas concentration	**C_{sg}(s)**	=	**0.00E+00**	**mg/m3**
D. SOURCE - Measured Soil Gas				
Measured soil gas concentration	**C_{sg}(m)**	=		**mg/m3 (ug/l)**

E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>>> 6.30E+00 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE				
Total porosity	θ	=	4.34E-01	dimensionless
Air-filled porosity	θ_a	=	2.84E-01	dimensionless
Diffusion coefficient in air	D_a	=	7.90E-02	cm2/sec
Effective diffusion coefficient	**D_e**	=	**6.34E-03**	cm2/sec
Depth of contamination or Csg	X	=	1.98E+01	m
Calculated Flux	**F_x**	=	**7.26E-04**	**mg/m2-hour**

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	9.68E+02	m2
% of floor area that flux occurs			1.00E+00	dimensionless
Attenuation factor(Crack factor)	S_b	=	1.00E-02	dimensionless
Flux area within building	Af	=	**9.68E+00**	m2
Interior Height of building	R_h	=	2.44E+00	m
Volume of building	V	=	**2.36E+03**	m3
Exchange rate of air	E	=	8.30E-01	exchanges/hr
Ventilation rate	Q	=	**1.96E+03**	m3/hr
Indoor air component	**C_i**	=	**3.58E-06**	**mg/m3**

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=		m
Wind speed	u	=		m/hr
Height of building openings (or height of breathing zone)	h	=		m
Outdoor air component	**C_o**	=	**0.00E+00**	**mg/m3**

C. TOTAL INDOOR AIR CONCENTRATION C_t = **3.58E-06** **mg/m3**

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01	kg
Inhalation rate	IR	=	2.00E+01	m3/day
Exposure duration	ED	=	2.50E+01	yrs
Hours per day	conversion		8.00E+00	hr/day
Exposure time	ET	=	**3.33E-01**	hr/24 hours
Days per week	conversion		2.50E+00	days/week
Weeks per year	conversion		5.00E+01	weeks/yr
Exposure frequency	EF	=	**1.25E+02**	days/yr
Averaging Time (carc. risk)	AT	=	2.56E+04	days
Averaging Time (non-carc. risk)	AT	=	**9.13E+03**	days
Chemical Intake (carc. risk)	**IT_c**	=	**4.17E-08**	**mg/kg-day**
Chemical Intake (non-carc. risk)	**IT_{nc}**	=	**1.17E-07**	**mg/kg-day**

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	**IT_{nc}**	=	1.17E-07	mg/kg-day
Reference dose	RfD	=	1.71E-01	mg/kg-day
Hazard Index	**HI**	=	**6.82E-07**	

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT_c	=	4.17E-08	mg/kg-day
Slope factor (potency)	SF	=	1.00E-02	1/(mg/kg-day)
Cancer Risk	**Risk**	=	**4.17E-10**	

CHEMICAL PARAMETERS

		MW (mg/mole)		H' (dimension-less)		Da (cm^2/sec)		VP (atm)	Temp. (°C)		K_{oc} (cm^3/g)		Water Solubility (mg/L-water)		CSF (inh) $(mg/kg\text{-}day)^{-1}$	Chronic RfD (inh) (mg/kg-day)
CAS No.																
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	a	2.4E-02	25	b	2.7E+02	a	2.0E+02	a	2.1E-02	1.0E-02
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	a	7.8E-01	25	b	6.5E+01	a	2.3E+03	a	1.75E-01	2.00E-02
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	a	3.7E-02	25	b	1.4E+02	a	5.3E+02	a	0.00E+00	8.57E-02
79-01-6	Trichloroethlyene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	a	7.6E-02	20	b	9.4E+01	a	1.1E+03	a	1.00E-02	1.71E-01

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html
c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/index
d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_select?select=csf
e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, http://www.arb.ca.gov/ab2588/riskassess.htm

Toxicity Value reference priority:
1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and March 2001 California Cancer Potency Values, http://www.oehha.ca.gov/risk/chemicalDB/inde:
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, September 13, 2001, http://www.arb.ca.gov/ab2588/riskassess.htm
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.